User's Manual

E1/E20 Emulator

Additional Document for User's Manual (Notes on Connection of RH850/P1M-C and RH850/P1H-C)

Supported Devices:
RH850 Family RH850/P1x Series

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(2012.4)

Contents

1. Outline

1.1 Features of an E1 or E20 emulator

An E1 or E20 emulator is an on-chip debugging emulator that includes a flash programming function, which is used for debugging and programming programs to be embedded in microcontrollers that have on-chip flash memory. That is, either product can debug a program while the target microcontroller is connected to the user system, and can write programs to the on-chip flash memory of microcontrollers.

1.2 Cautions on using the E20 emulator

The functions used for debugging of the RH850 family by using the E20 emulator are the same as in the E1 emulator. Large trace function, characteristic functions of the E20 emulator, cannot be used.

1.3 Configuration of manuals

Documentation for the E1 or E20 emulator manual is in two parts: the E1 or E20 Emulator User's Manual and E1 or E20 Emulator Additional Document for User's Manual (this manual). The additional document is for a particular set of MCUs (in this case, MCUs of the RH850/P1M-C and RH850/P1H-C groups). Be sure to read both of the manuals before using the E1 or E20 emulator.

(1) E1 or E20 emulator user's manual

The E1/E20 Emulator User's Manual describes hardware specifications including the following items:

- Components of the emulators
- Emulator hardware specifications
- Connecting the emulator to a host computer and user system

(2) E1 or E20 emulator additional document for user's manual

An E1 or E20 Emulator Additional Document for User's Manual describes functions of a debugger, and its contents depend on the given set of MCUs. In general, an additional document has notes on items including the following:

- For use in hardware design, an example of connection and the interface circuits required to connect the emulator.
- Notes on using the emulator

2. Connecting the Emulator and User System

To connect the E1 or E20 emulator, a connector for the user system interface cable must be mounted on the user system. When designing the user system, read this chapter of this manual and the hardware manual for the MCUs to be used.

2.1 Connector mounted on the user system

Table 2-1 shows the recommended connectors for connection of the E1 or E20 emulator.

Table 2-1 Recommended Connectors

	Type Number	Manufacturer	Specification
14-pin connector	7614-6002	Sumitomo 3M Limited	14-pin straight type (Japan)
	2514-6002	3M Limited	14-pin straight type (other countries)

Figures 2-1 shows an example of the connection of the user system interface cable of an E1 emulator to a 14-pin connector. If you intend to use the 14-pin connector, do not mount components with heights exceeding 10 mm within 5 mm of the connector on the user system. Note that this connector does not support direct connection of an E20 emulator, which has a 38-pin connection. To use an E20 emulator with a 14-pin connector, use the 38-pin/14-pin conversion adapter [R0E000200CKA00] that comes with the E20.

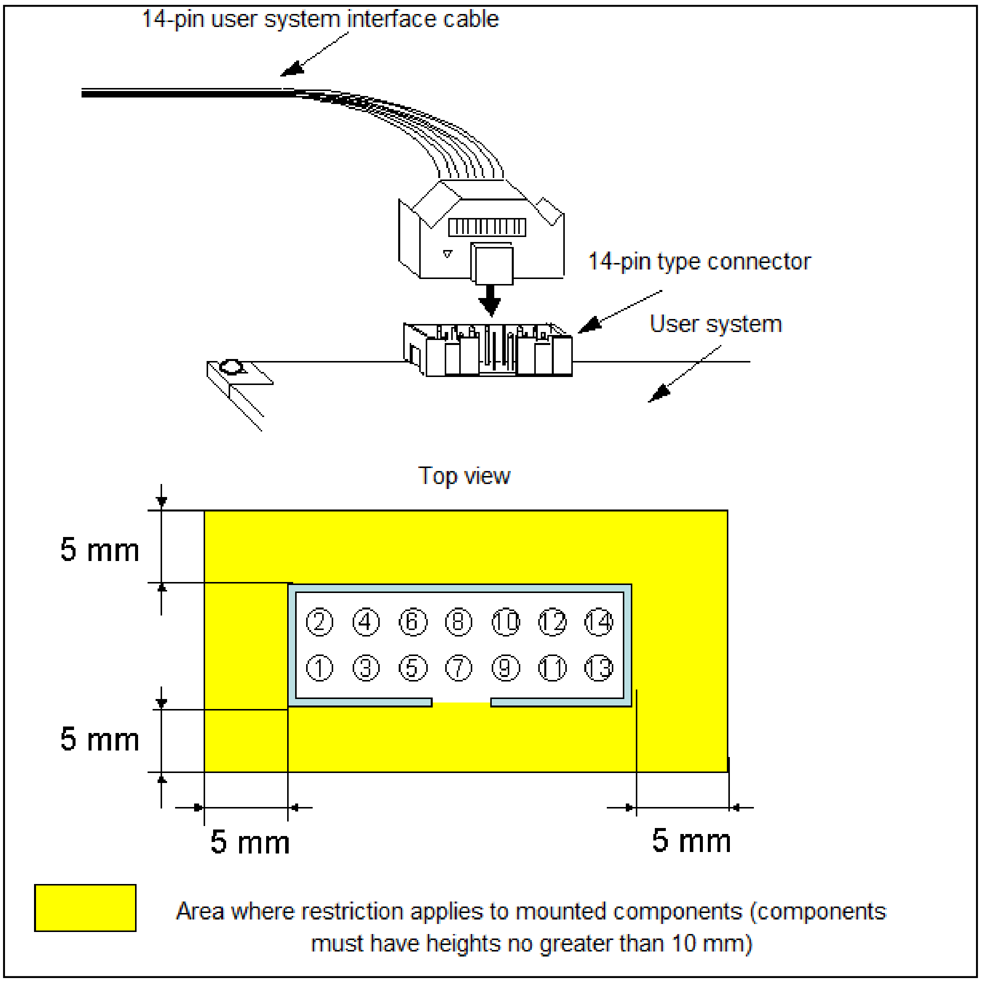
14-pin user system interface cable
14-pin type connector
User system
Top view
5 mm
5 mm
② ④ ⑥ ⑧ ⑩ ⑫ ⑭
① ③ ⑤ ⑦ ⑨ ⑪ ⑬
5 mm
5 mm
Area where restriction applies to mounted components (components must have heights no greater than 10 mm)

Figure 2-1 Connecting the User System Interface Cable to the 14-pin Connector in the E1 or E20 Emulator

⚠ **CAUTION**

Note on connector insertion and removal:

When connecting or disconnecting the user-system interface cable and the emulator or user system, grasp the connector cover at the end of the cable. Pulling the cable itself will damage the wiring.

Also, be aware that the user-system interface cable has the direction in which it must be inserted. If the cable is connected in the wrong direction, it may be damaged.

2.2 Pin assignments of the connector

Table 2-2 shows the pin assignments of the 14-pin connector.

Table 2-2 Pin Assignments of the 14-pin Connector

Pin No.	Signal name (#:active low)			I/O (*3)
	Debugging	**Programming**		
	4-pin LPD	**2-wire UART**	**1-wire UART**	
1	LPDCLK	—	—	Input
2 (*1)	GND	GND	GND	—
3	TRST#	—	—	Input
4	FPMD0	FPMD0	FPMD0	Input
5	LPDO	FPDT	—	Output
6	—	—	—	—
7	LPDIO	FPDR	FPDR	I/O
8	TVDD	TVDD	TVDD	—
9	—	—	—	—
10	—	—	—	—
11	LPDCLKO	—	—	Output
12 (*1)	GND	GND	GND	—
13 (*2)	RESET#	RESET#	RESET#	Input
14 (*1)	GND	GND	GND	—

Notes
1. Securely connect pins 2, 12, and 14 of the connector to GND of the user system. These pins are used for electrical GND and to monitor connection with the user system by the E1 or E20 emulator.
2. Be particularly sure to connect pin 13 before using the emulator.
3. Input and output are defined from the perspective of the user system.

2.3 Examples of recommended connections between the connector and MCU

This section describes examples of recommended connections between the target MCU and interface circuit.

2.3.1 Example of recommended connections

Multiple recommended examples for connection are given in accord with the purposes for which the emulator is to be used. Select the appropriate circuit with reference to the table shown below. Be sure to take the specifications of the target device as well as measures to prevent noise into consideration when designing your circuit.

Purpose	Figure
Both debugging (4-pin LPD) and programming (2-wire UART or 1-wire UART)	Figure 2-2
Only programming (1-wire UART or 2-wire UART)	Figure 2-3
Only programming (1-wire UART)	Figure 2-4

(1) Connection which allows Both debugging (4-pin LPD) and programming (2-wire UART or 1-wire UART).

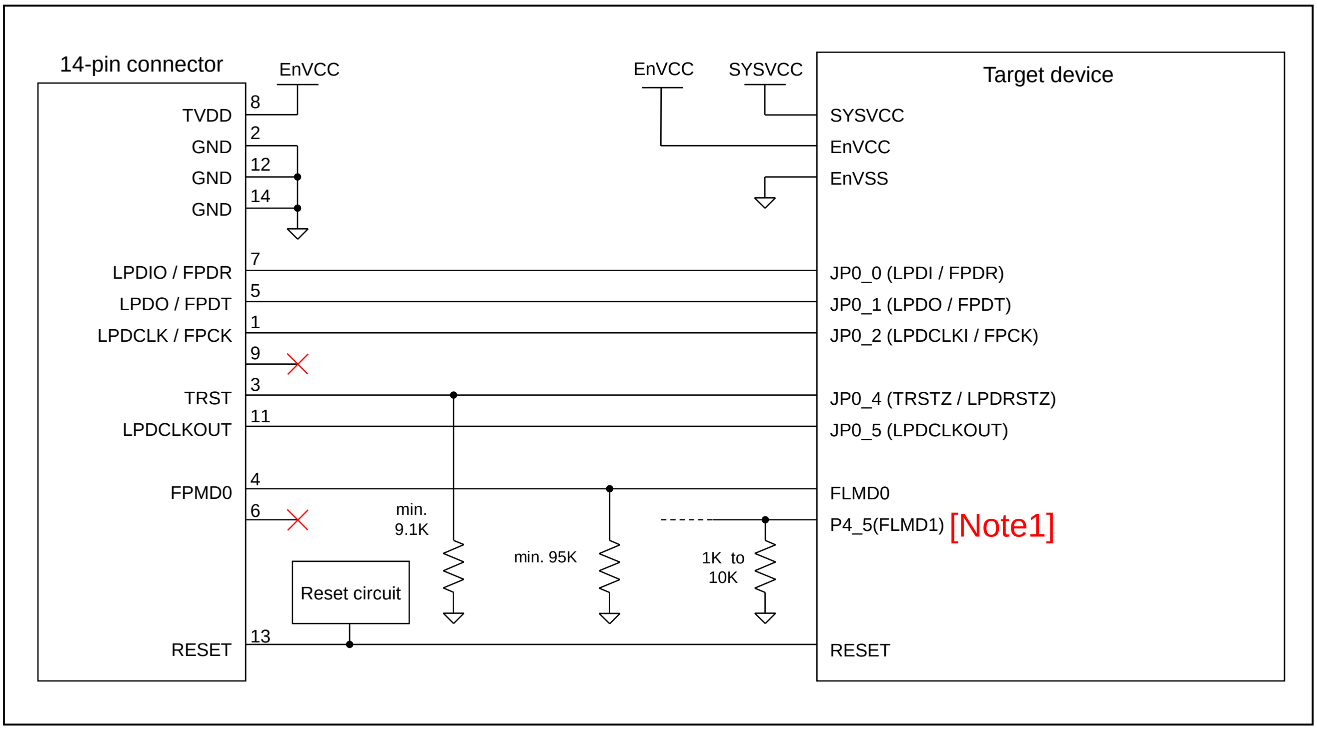

Figure 2-2 Example of Connection

- Refer to section 2.3.2, Connecting the RESET pin, for more information on the reset circuit.
- For details on TVDD, refer to section 2.3.3, Connecting the TVDD pin.
- Make wiring runs between the 14-pin connector and target device as short as possible (within 50 mm is recommended). Do not connect the signal lines between the connector and MCU to other signal lines.
- Use GND to apply a guard ring for the wiring runs between the 14-pin connector and target device. Do not route high-speed signal lines parallel to each other or allow them to cross each other.
- Pin names may vary among target devices. Refer to the user's manual for the target device you are using for the actual pin names.
- Proceed with appropriate processing for pins of target devices which do not require connection to the emulator in accord with the descriptions in "Handling of Unused Pins" in the user's manual for the target device.

Note 1: Design the circuit so that the FLMD1 pin must be at the low level during programming.

(2) Connection which allows Only programming (1-wire UART or 2-wire UART).

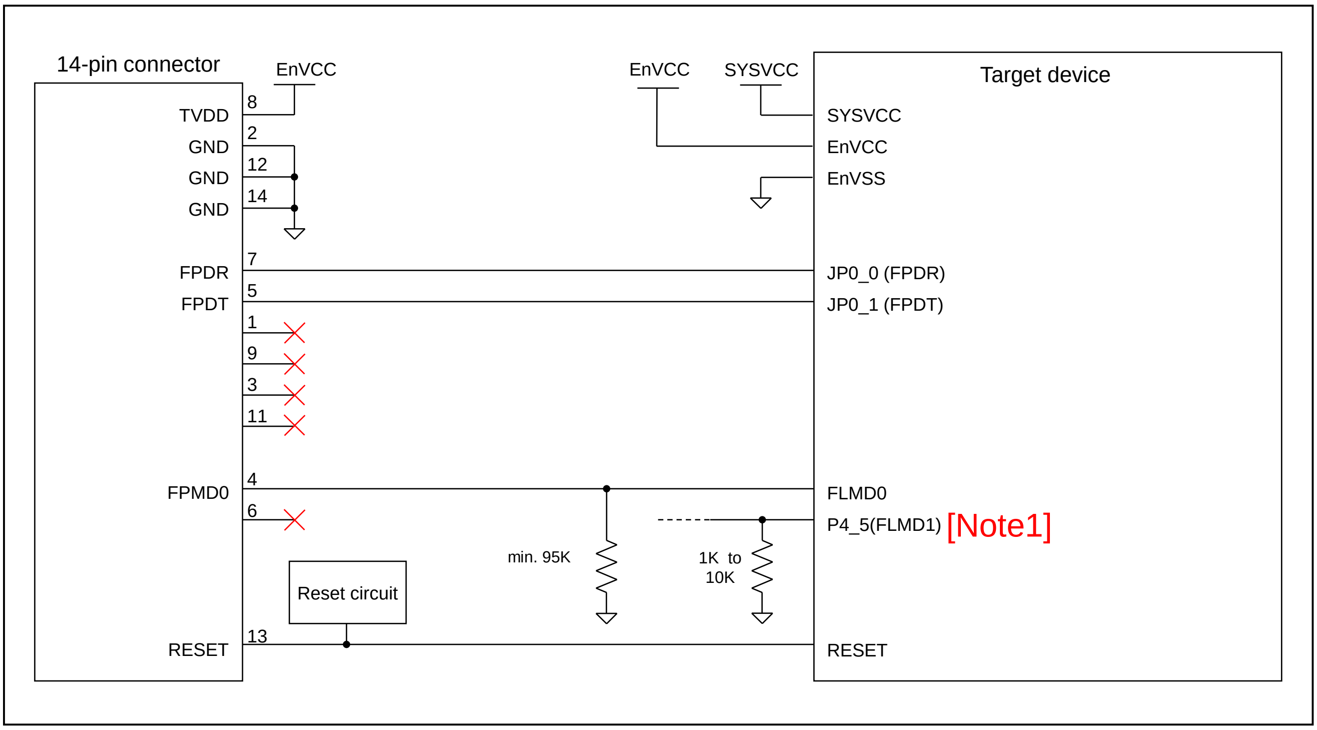

Figure 2-3 Example of Connection

- Refer to section 2.3.2, Connecting the RESET pin, for more information on the reset circuit.
- For details on TVDD, refer to section 2.3.3, Connecting the TVDD pin.
- Make wiring runs between the 14-pin connector and target device as short as possible (within 50 mm is recommended). Do not connect the signal lines between the connector and MCU to other signal lines.
- Use GND to apply a guard ring for the wiring runs between the 14-pin connector and target device. Do not route high-speed signal lines parallel to each other or allow them to cross each other.
- Pin names may vary among target devices. Refer to the user’s manual for the target device you are using for the actual pin names.
- Proceed with appropriate processing for pins of target devices which do not require connection to the emulator in accord with the descriptions in “Handling of Unused Pins” in the user’s manual for the target device.

Note 1: Design the circuit so that the FLMD1 pin must be at the low level during programming.

(3) Connection which allows Only programming (1-wire UART).

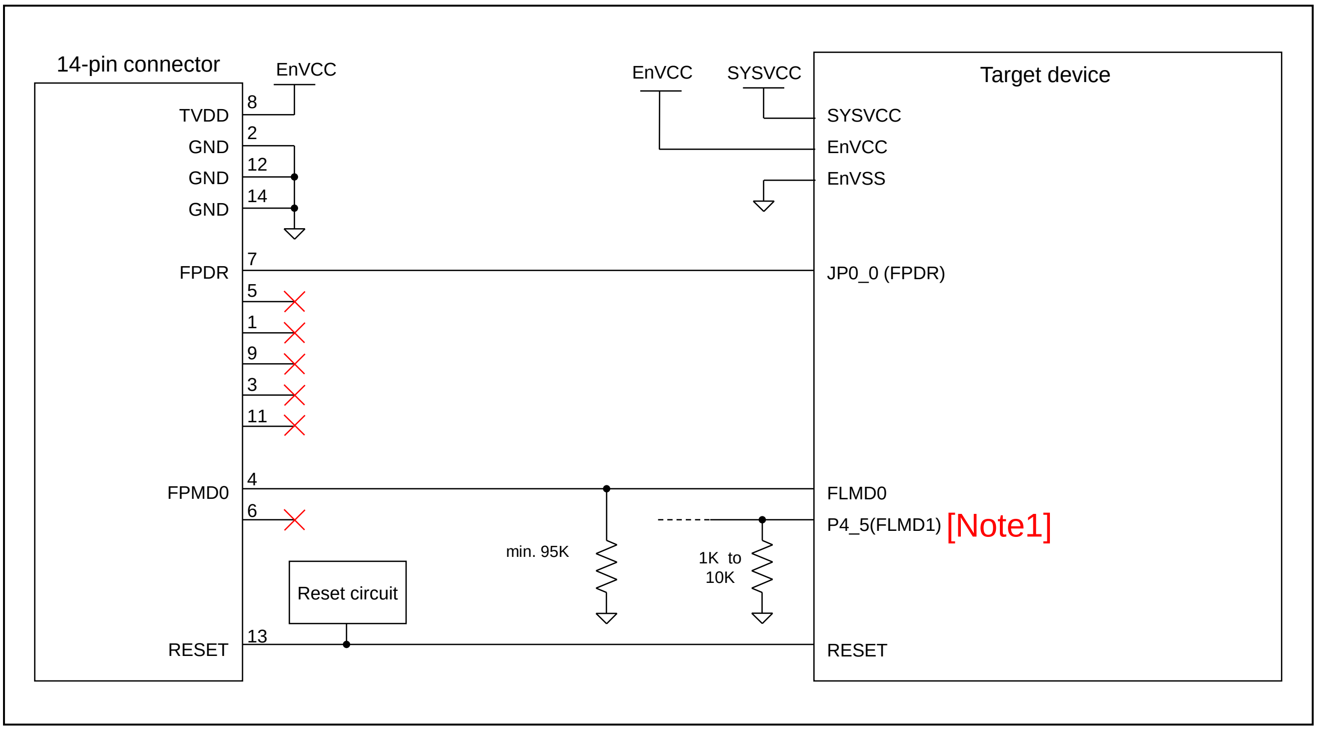

Figure 2-4 Example of Connection

- Refer to section 2.3.2, Connecting the RESET pin, for more information on the reset circuit.
- For details on TVDD, refer to section 2.3.3, Connecting the TVDD pin.
- Make wiring runs between the 14-pin connector and target device as short as possible (within 50 mm is recommended). Do not connect the signal lines between the connector and MCU to other signal lines.
- Use GND to apply a guard ring for the wiring runs between the 14-pin connector and target device. Do not route high-speed signal lines parallel to each other or allow them to cross each other.
- Pin names may vary among target devices. Refer to the user’s manual for the target device you are using for the actual pin names.
- Proceed with appropriate processing for pins of target devices which do not require connection to the emulator in accord with the descriptions in “Handling of Unused Pins” in the user’s manual for the target device.

Note 1: Design the circuit so that the FLMD1 pin must be at the low level during programming.

2.3.2 Connecting the RESET Pin

While you are using the E1 or E20 emulator, pin 13 (RESET pin) of the 14-pin connector must be connected to the reset pin of the target device. Figure 2-5 below shows an example.

The E1 or E20 emulator fixes the RESET pin to the low level before the debugger is activated. After the debugger is activated, the emulator either keeps the pin at the low level or places it in the high-impedance state in accord with the operation of the debugger.

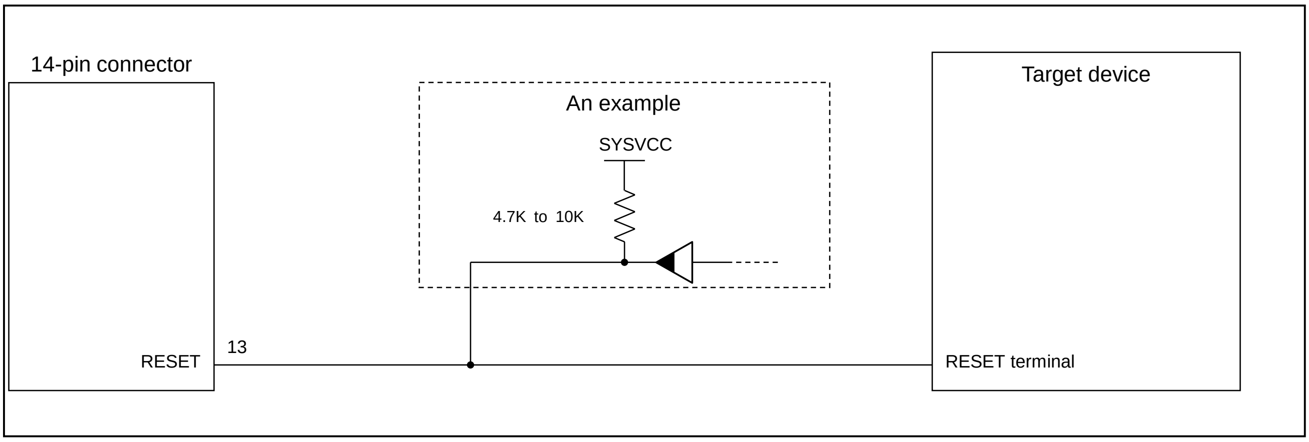

Figure 2-5 Example of Connecting Reset Circuit

- Output of the reset circuit should be either n-channel open drain or be a signal generated solely by a resistor and capacitor (and possible other components).
- The maximum sink current accepted by the RESET pin of the E1 or E20 emulator is 2 mA. Select an appropriate pull-up resistance which does not surpass this value.
- For the target device in this document, pull the RESET signal up to the SYSVCC voltage.
- Adjust the time constant of the reset circuit so that the time elapsing before the signal reaches 80% of the high level from the low level is within 900 us.
- When you use hot plug-in, consider installation of a capacitor between the reset signal and GND in order to suppress a noise. In this case, however, the specifications of the time described above must be satisfied.

2.3.3 Connecting the TVDD pin

(1) Power source monitoring function

Connect the power source on the user system to pin 8 (TVDD pin) of the 14-pin connector. For the RH850/P1x series, this will be the source of the EnVCC voltage.

The power source connected to the TVDD pin provides power to the final stage output buffer and first stage input buffer on the E1/E20 emulator circuit. When the E1 or E20 emulator is connected, it will draw current as described below in addition to the current drawn by the user system.

- E1 emulator: Approx. 20 mA when TVDD is 3.3 V, and approx. 40 mA when TVDD is 5.0 V
- E20 emulator: Approx. 40 mA when TVDD is 3.3V, and approx. 100 mA when TVDD is 5.0 V

If there is a possibility you will be using hot plug-in, you will need to configure the circuit as shown below.

Pin 8 of the E1 emulator is connected to a 4.7-uF capacitor as shown in (1) in Figure 2-6, so hot plug-in connection of the emulator may lead to a momentary drop in the power-supply voltage on the user system. This might cause the MCU to be reset.

As shown in (2) in Figure 2-6, this effect can be reduced by placing a ferrite bead (or inductor) and relatively large capacitor with low equivalent series resistance near the TVDD line of the connector for connection of the emulator. Note that this measure will not completely eliminate the voltage drop. Note that hot plug-in is only for use during debugging, and a separately sold hot plug-in adapter is necessary to use this function otherwise.

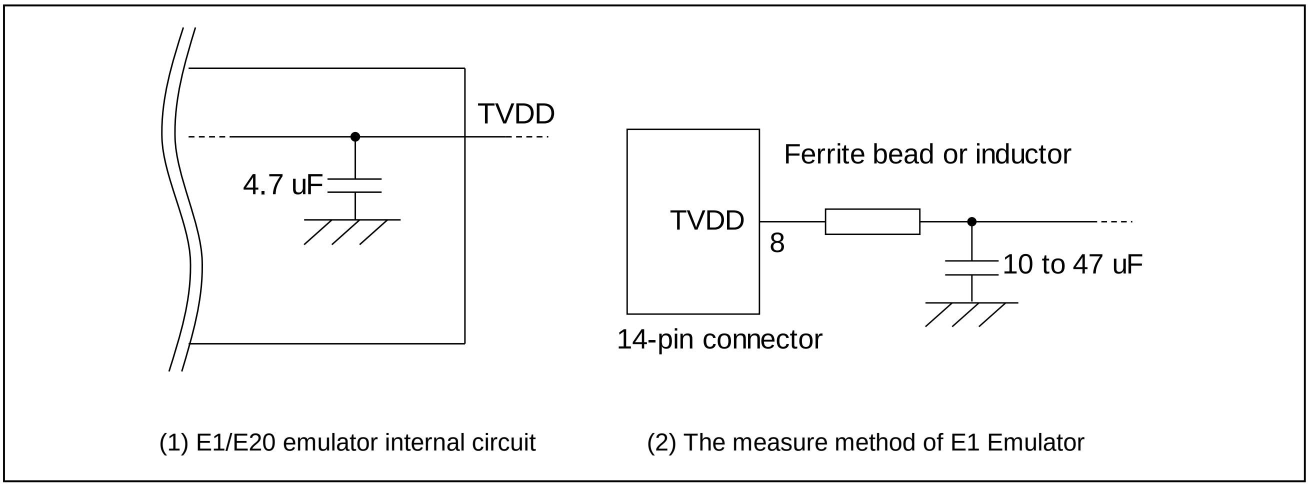
TVDD
4.7 uF
Ferrite bead or inductor
TVDD
8
10 to 47 uF
14-pin connector
(1) E1/E20 emulator internal circuit
(2) The measure method of E1 Emulator

Figure 2-6 Circuit Configuration for Hot Plug-in

(2) Power supply function (applies only to the E1 emulator)

The E1 emulator can also supply power at 3.3 V or 5.0 V from the TVDD pin to the user system (at a current of up to 200 mA). When using this function, take care of the following points.

- Do not use this function if power is being separately supplied to the user system. Attempting to do so might break the E1 emulator.

- Do not use this function for a user system which draws a current of 200 mA or more. The E1 emulator or USB interface of the host machine might be broken.

- Make sure that the supplied voltage is within the voltage range required by the user system.

- The 5.0-V supply depends on the voltage of the USB interface (VBUS) of the host machine. Depending on the environment of the host machine in use, the voltage might be lower than 5.0 V by 0.5 V or more.

Power supply from the E1 emulator depends on the quality of the USB power supply of the host machine, and as such, precision is not guaranteed. When writing a program that requires reliability, do not use the power supply function of the E1 emulator. Use a stable, separate power supply for the user system. When writing a program for mass production processes, use the Renesas Flash Programmer.
For details on the flash programming software, refer to
http://www.renesas.com/products/tools/flash_prom_programming/ .

WARNING

Warning for Turning the Power On/Off:

When supplying power, ensure that there are no shorts between the user system and power circuit. Only connect the E1 or E20 after confirming that there are no mismatches of alignment on the user system port connector. Incorrect connection will result in the host machine, the emulator, and the user system emitting smoke or catching fire.

2.3.4 Hot plug-in adapter for the E1 emulator

For hot plug-in connection, use the hot plug-in adapter for the E1 emulator (R0E000010ACB00) that is separately available from Renesas.

2.3.5 Isolator for the E1 emulator

For a debugging environment where there is a difference in potential between the GND of the user system and that of the host PC, use the isolator for the E1 emulator (R0E000010ACB20) which is separately available from Renesas.

2.3.6 Small connector conversion adapter for the E1 emulator

A small connector conversion adapter for the E1 emulator (R0E000010CKZ11) is separately available from Renesas for user system boards which are too small to mount the 14-pin connector that is the standard connector for the E1 emulator. By using the adapter, you can reduce the area taken up by the connector mounted on your system.
However, when you use the small connector conversion adapter for the E1 emulator, be aware that the pin assignments of the connector differ from those of the standard interface connector for the E1 emulator.

3. Specifications

Specifications are shown in the table below.

Broad Category	Medium Category		Narrow Category	Specification
Hardware in general	Corresponding host machine			Computer equipped with a USB port, OS depends on the debugger
	User system interface			14-pin connector
	Host machine interface			USB 2.0 (full speed or high speed)
	Connection to the user system			Connection by the provided user system interface cable
	Power supply function (only when the emulator is an E1)			3.3 V or 5.0 V (with current up to 200 mA) can be supplied from TVDD to the user system (make settings with the debugger)
	Power supply for the emulator			No need (the host computer supplies power through the USB)
Debugging-related items	Break		Software break	ROM area: 2000 points RAM area: Not available
			Hardware break	12 points including those used for both execution and CPU access conditions (8 points only for execution conditions, and 4 points for either execution or access conditions)
			Forced break	Available
	Event		Number of events that can be set	8 points for execution, 8 points for CPU access, 4 points for DMA access, and 4 points for GRAM access
			Available function	Break, performance measurement
			Combination of events	OR, sequential
	Performance measurement	Time (1)	Measurement section	From run to break
			Items measured	Execution time
			Performance	32-bit counters
		Time (2)	Measurement section	From run to break, or between two event points
			Items measured	Execution time, total execution time, pass count, maximum execution time, minimum execution time
			Performance	32-bit counters (for three sections)
		Other than time	Items measured	Number of instructions executed (all or branches only), number of interrupts accepted (EI level or FE level), number of exceptions accepted (instruction asynchronous or instruction synchronous), clock cycles (all, while interrupts are inhibited, or other than for the processing of interrupts), number of instruction fetches requested, number of hits on the instruction cache
			Measurement section	From run to break, or between two event points
			Items measured	Latest value, total value, pass count, maximum value, minimum value
			Performance	32-bit counters (for four sections)
	Pseudo real-time RAM monitor			Available (occupies a bus (steals cycles))
	Direct memory modification			Available (occupies a bus (steals cycles))
	Debugging console			Unavailable
	Downloading of the external flash memory			Not possible
	Hot plug-in (requires a separately sold hot plug-in adapter)			Possible
	Peripheral breaks			Available*

	Security	32-byte ID code authentication
	Connection interface	4-pin LPD (5.5 MHz/11 MHz)
Programming-related items	Security flag settings	Available
	Connection interface	2-wire UART, 1-wire UART

Note: The function to stop peripheral I/O operation in a break is called the peripheral break function.
Whether peripheral breaks are set or not is determined by the debugger.
Refer to the manual for the debugger you are using for how to set them.
Refer to the manual for the MCU you are using to check whether peripheral breaks are set.

4. Notes on Usage

Cautionary notes on using the E1 or E20 emulator are given below.

4.1 Notes on differences in operation between the actual device and the E1 or E20 emulator

No. 1 Cautionary note on the DBTRAP instruction

The DBTRAP instruction is used for software breaks and thus cannot be used in programs with the emulator.

No. 2 AUDR function

When an emulator is connected, the advanced user debugger RAM monitoring (AUDR) function, which supports debugging of a program while mounted on a system, cannot be used.

No. 3 Serial programming function

The serial programming function cannot be used with the emulator during debugging.

No. 4 HALT mode

A break leads to release from HALT mode.

No. 5 Current drawn

The amount of current drawn by an emulator is different from the actual device. The target device consumes more power during debugging than in normal operation since the debugging functions are operating.

No. 6 OTP flag

Do not set the one-time programming (OTP) flag in self-programming with the emulator. Setting the flag makes further debugging impossible.

No. 7 Operations in response to resets and interrupts when an emulator is in use

When an emulator is in use, operation in response to resets and interrupts differs according to the specifications of the reset mask and interrupt settings, respectively, as shown in the tables below.

Table 4-1 Relation between the State of Emulation and Presence of a Reset Mask

Reset mask specification with an emulator	**State of emulation and presence of a reset mask**			
	In user program execution	**In single stepping**	**In C-source-level stepping**	**In breaks**
Mask specified	Masked	Masked	Masked	Masked
Mask not specified	Not masked	Masked	Depends on the debugger	Masked

Note: Do not allow the generation of a reset in the form of a pin reset other than while the program is in execution regardless of presence of a mask above.

Table 4-2 Relation between the State of Emulation and Acceptance of Interrupts

Settings for interrupts	**State of emulation and acceptance of interrupts**			
	In user program execution	**In single stepping**	**In C-source-level stepping**	**In breaks**
DI	Not accepted	Not accepted	Not accepted	Not accepted
EI	Accepted	Some held pending*	Depends on the debugger	Held pending

Note: Exceptions that are held pending are EIINT, FEINT, and FPI, and the other exceptions are all accepted.

No. 8 Option byte register

The debugger cannot write new values to the bits of the option byte register indicated below since they are used by the emulator. Also, do not attempt self-programming to write new values to these bits.

- OPJTAG1 and OPJTAG0 bits (bits 30 and 29 of the OPBT2 register)

The value of the OPJTAG1 and OPJTAG0 bits while an emulator is connected is "01B" if the 4-pin LPD interface is selected.

4.2 Cautionary notes on debugging

No. 1 Handling of devices which were used for debugging

Do not use devices that were used for debugging in mass-production. This is because writing to the flash memory of such devices has already proceeded during debugging, so we cannot guarantee the number of times rewriting of the flash memory can proceed. Debugger errors occur when programming of the flash memory is no longer possible. Replace the device in such situations.

No. 2 Power to the target system while debugging

Do not turn the power to the target system off during debugging. Doing so will require reconnection of the debugger.

No. 3 Hardware break (access) function

When the hardware break (access) function is in use, a break in response to the reading or writing of specified data by a read–modify–write instruction will occur after the instruction. Other hardware breaks (access) occur before the instruction.

No. 4 Multiplexed functions of pins used for OCD signals

Multiplexed functions of pins used for on-chip debugging (OCD) cannot be used during debugging.

No. 5 Debugging interface

The E1 and E2 emulators support only 4-pin LPD interface.

Operation is as follows if the setting of the OPJTAG1 and OPJTAG0 bits of the option byte 2 register is "11B" (JTAG: the JTAG interface is selected in the case of a blank chip).

a. When starting (connecting) the E1 or E20 emulator

Settings of the option byte 2 register are changed from the setting for JTAG to that for 4-pin LPD by the debugger on connection to an emulator.

Therefore, the OPJTAG1 and OPJTAG0 bits of the option byte 2 register are "01B" (4-pin LPD) during emulator operation.

b. When exiting from a session with (disconnecting) the E1 or E20 emulator

Settings of the option byte 2 register can be changed by the debugger.

- The value of the the OPJTAG1 and OPJTAG0 bits of the option byte 2 register can be changed to "11B" (for JTAG), which requires rewriting of the flash memory.
- The setting of the the OPJTAG1 and OPJTAG0 bits of the option byte 2 register can be left as "01B" (4-pin LPD).

When 4-pin LPD interface is also used the next time the emulator is connected, we recommend exit from the program without changing the settings from that for the 4-pin LPD interface.

If power to the target system is turned off because of an abnormal end to the emulator session, the OPJTAG1 and OPJTAG0 bits of the option byte 2 register retain the value "01B" (for 4-pin LPD). If you wish to change the OPJTAG1 and OPJTAG0 bits of the option byte 2 register to "11B" (for JTAG), please do so at the end of the E1 or E20 emulator session.

No. 6 Reset of pins

Do not allow the generation of a reset in the form of a pin reset other than while the program is in execution. If a reset is generated in this situation, the debugger may hang. Even if the reset mask setting in the debugger is for masking, the debugger may still hang.

No. 7 Quality of flash programming

To improve the quality, follow the guidelines below.

- Circuits are designed as described in the user's manuals for the MCU and E1 or E20 emulator.
- The MCU, E1 or E20 emulator, and the software are used as described in respective user's manuals.
- The supply of power to the user system is stable.

No. 8 Turing the power on/off

Turn the power of the E1 or E20 emulator and the user system following the procedure below.

- When a separate power supply is used for the user system

<When using the emulator>

(1) Check the power is off.
Check that the user system is turned off. When using the E20 emulator, check its power switch is off.

(2) Connect the user system.
Connect the emulator and the user system with a user-system interface cable.

(3) Connect the host machine and turn on the emulator.
Connect the emulator and the host machine with a USB interface cable. The E1 emulator is turned on by connecting the USB interface cable. When using the E20 emulator, turn on its power switch.

(4) Turn on the user system.
Turn on the user system.

(5) Launch the debugger.
Launch the debugger.

<When finished using the emulator>

(1) Close the debugger.
Close the debugger.

(2) Turn off the user system.
Turn off the user system.

(3) Turn off the emulator and disconnect the emulator.
When using the E20 emulator, turn off its power switch. Disconnect the USB interface cable from the E1 or E20 emulator. The E1 emulator is turned off by disconnecting from the USB interface cable.

(4) Disconnecting the user system.
Disconnect the user-system interface cable from the user system.

⚠CAUTION

Notes on the User System Power Supply:

❗ While the power of the user system is on, do not turn off the host machine, unplug the USB interface cable, or turn off the power switch of the E20 emulator.
The user system may be damaged due to leakage current.

- When Power is supplied to the user system from the emulator (E1 emulator)

<When using the emulator>

(1) Check the power is off.
Check that the user system is turned off.

(2) Connect the user system.
Connect the emulator and user system with a user-system interface cable.

(3) Connect the host machine and turn on the emulator.
Connect the emulator and host machine with a USB interface cable, then turn on the emulator.

(4) Launch the debugger.
Launch the debugger and select the setting of power supply to the user system.

<When finished using the emulator>

(1) Close the debugger.
Close the debugger.

(2) Turn off the emulator and disconnect the emulator.
Disconnect the USB interface cable from the emulator, then turn off the emulator.

(3) Disconnecting the user system.
Disconnect the user-system interface cable from the user system.

No. 9 Software resets and debugging

Resets are always masked during single-step execution and breaks. Whether resets are masked during C-source-level stepped execution depends on the facilities of the debugger. Software resets will not be generated during single step execution in response to processing for setting a software reset, or when the debugger writes to the setting register for a software reset during a break (the request for a reset will be held).

No. 10 Interrupts when stepped execution is in use

EIINT, FEINT, and FPI are held pending if they occur during single step execution. Other interrupts are always accepted. Acceptance of interrupts during C-source-level step execution depends on the facilities of the debugger.

No. 11 Stepped execution of the HALT instruction

When a HALT instruction is encountered during single step execution (execution in units of assembly instruction), a break is set at the next instruction following the HALT instruction, and the mode does not change to the HALT mode. When a HALT instruction is encountered during C-source-level stepped execution, whether or not the transition to the HALT mode proceeds depends on the facilities of the debugger.

No. 12 Cautionary note when the emulator is connected (pin reset)

The reset signal continuing to be asserted while communications between the emulator and MCU are being prepared when the emulator is started raises the possibility of incorrect communications. Thus, ensure that the reset signal does not remain asserted when the emulator is started.

No. 13 Cautionary note on connecting an emulator (time required for preparing to communicate)

When an emulator is connected, a program which was written to the MCU is executed from the reset vector before the OCD emulator and MCU become able to communicate. Take care on this point.

When debugging of a program written to the MCU creates a problem, eliminate the problem by inserting at least 30-ms waiting time* before executing the program after a release from the reset state.

Note: Time required for preparing communications depends on the host PC environment of the E1 or E20 emulator and the operating frequency of the MCU.

No. 14 Cautionary note when the emulator is connected (internal reset)

When the stored program generates an internal reset (software reset or reset caused by the watchdog timer overflowing) immediately after release from the initial reset state, the internal reset may be generated before communications between the emulator and MCU have been established after the emulator is started, raising the possibility of incorrect communications.

Accordingly, insert a wait of at least 30 ms* before applying an internal reset after release from the initial reset state when debugging a program which includes an internal reset immediately after release from the initial reset state.

Note: Time required for preparing communications depends on the host PC environment of the E1 or E20 emulator and the operating frequency of the MCU.

No. 15 Access to I/O resources in the MCU

Access to I/O resources (registers and RAM) in the MCU by the debugger (i.e. access through the memory or I/O register window) proceeds in the same way as access from a user program.

Examples (for the actual operation of I/O resources, refer to the manual of the MCU you are using)

- Access to DTC-RAM resources

  Normal access will not proceed unless a master (i.e. CPU1 or CPU2) is allocated to use the channel. When access is attempted while a master has not been allocated, an error will be detected on the ECM side.
- Access to FCU-RAM resources

  Normal access will not proceed unless the FCU-RAM enable bit is set.
- Access to the PBG guard area

  Attempted access to the PBG guard area will not proceed while the guard is enabled.

No. 16 Cautionary point regarding hot plug-in connection

- When the OPJTAG [1:0] bits of the option byte register are not set for the LPD operation mode at the time of hot plug-in connection, a connection error occurs. Thus, before proceeding with hot plug-in connection, set the OPJTAG [1:0] bits for the LPD operation mode.
- Allowing hot plug-in connection prevents usage of the optional isolator for the E1 emulator (the isolator is only for use with the RH850 and RL78 groups).
- Allowing hot plug-in connection prevents the supply of power to the user system by the E1 emulator.
- After completing hot plug-in connection, the user program will be running. At this time, only the emulator functions listed below are available.

  Forced break

  Pseudo real-time RAM monitor

  Direct changes to values in memory

  Apply a forced break if you wish to return to using all functions supported by the emulator. After the forced break, functions equivalent to those that can be used after normal starting of a program become available.

No. 17 Cases where hot plug-in connection is not possible

Hot plug-in connection cannot be used when the MCU is in the reset input state.

No. 18 Cautionary note on asynchronous debugging mode (peripheral break function)

In the asynchronous debugging mode, peripheral break functions cannot be used. Even if peripheral break functions are enabled, peripheral macros are not stopped.

No. 19 Cautionary note on asynchronous debugging mode (reset)

In the asynchronous debugging mode, when any of CPUs is in the break state, no resets are acceptable.

No. 20 Cautionary note on asynchronous debugging mode (watchdog timer)

In the asynchronous debugging mode, when CPU1 is in the break state, a counter is stopped in WDTA0. When CPU2 is in the break state, a counter is stopped in WDTA1.

No. 21 Cautionary note on asynchronous debugging mode (ECC error)

During execution of a user program, there may be a case that the ECC error function does not normally operate for flash memory resources.

Example: When any CPU accesses flash memory resources during execution of a user program causing an ECC error and another CPU which is in the break state accesses the same resources in the memory window at the same timing, the debugger temporarily controls the ECC error and no ECC error occurs in any CPU.

No. 22 Cautionary note on asynchronous debugging mode (specific sequence)

During execution of a user program, there may be a case that the specific sequence is not satisfied.

Example: When any CPU accesses the specific I/O register during execution of a user program and another CPU which is in the break state accesses the same peripheral function in the I/O register window at the same timing, the specific sequence from any CPU is not satisfied and normal accessing is disabled.

No. 23 Performance measurement

In the case of measuring a specific section, if the intervals between the start and the end of one measurement, and between the end of that measurement and the start of the next is short, the measurement might not be possible. To obtain correct measurements, the interval* should be long enough.

*: The required detection interval depends on the operating frequency and the LPD communications frequency of the MCU.

5. Internal Circuits of the Emulator

The internal interface circuits related to the communications interface between the E1 or E20 emulator and user system are shown in figures A and B below. Please refer to these figures when determining parameters in board design.

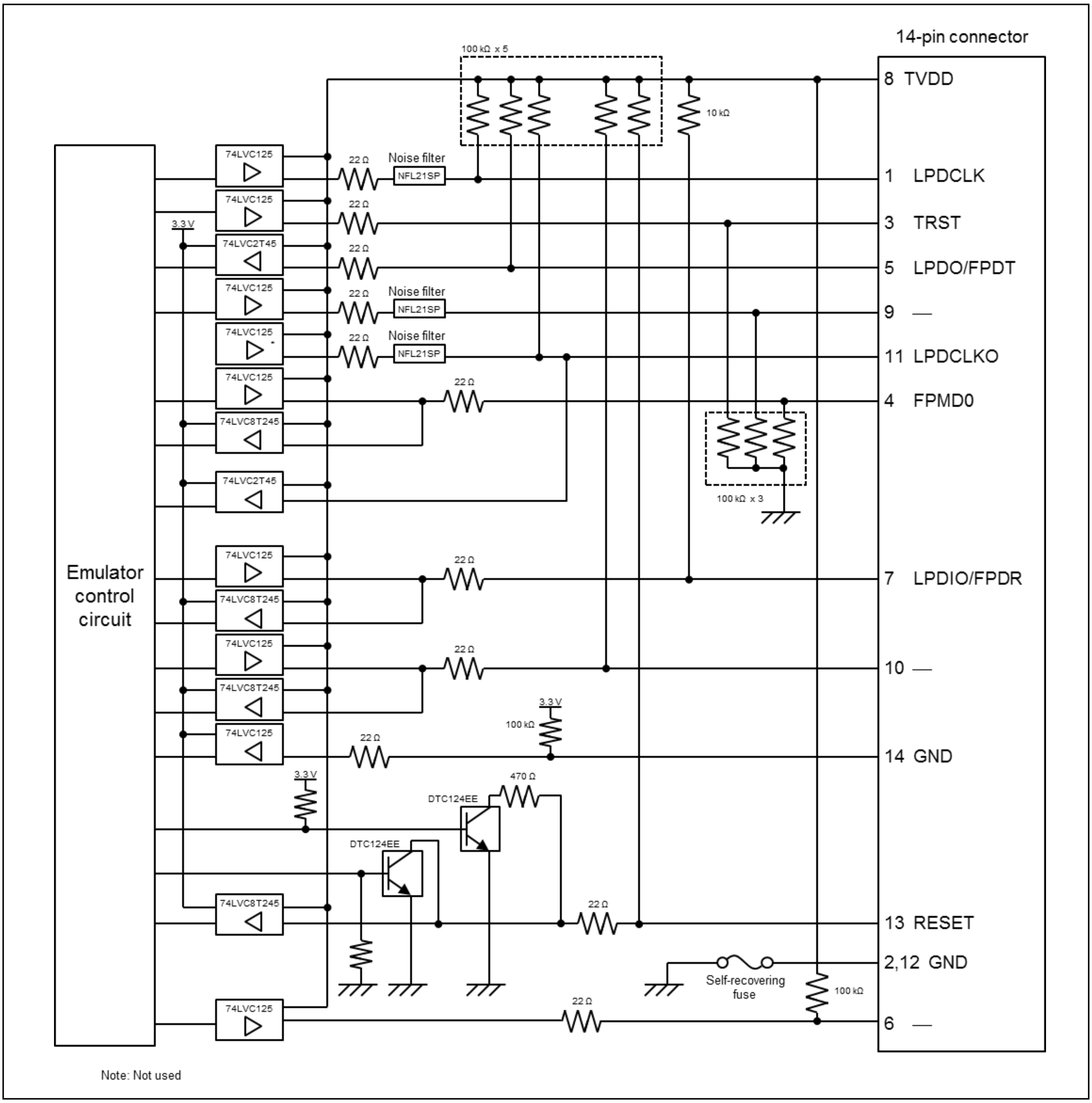

Figure A Interface Circuits in the E1 or E20 Emulator (4-Pin LPD, 2-Wire UART)

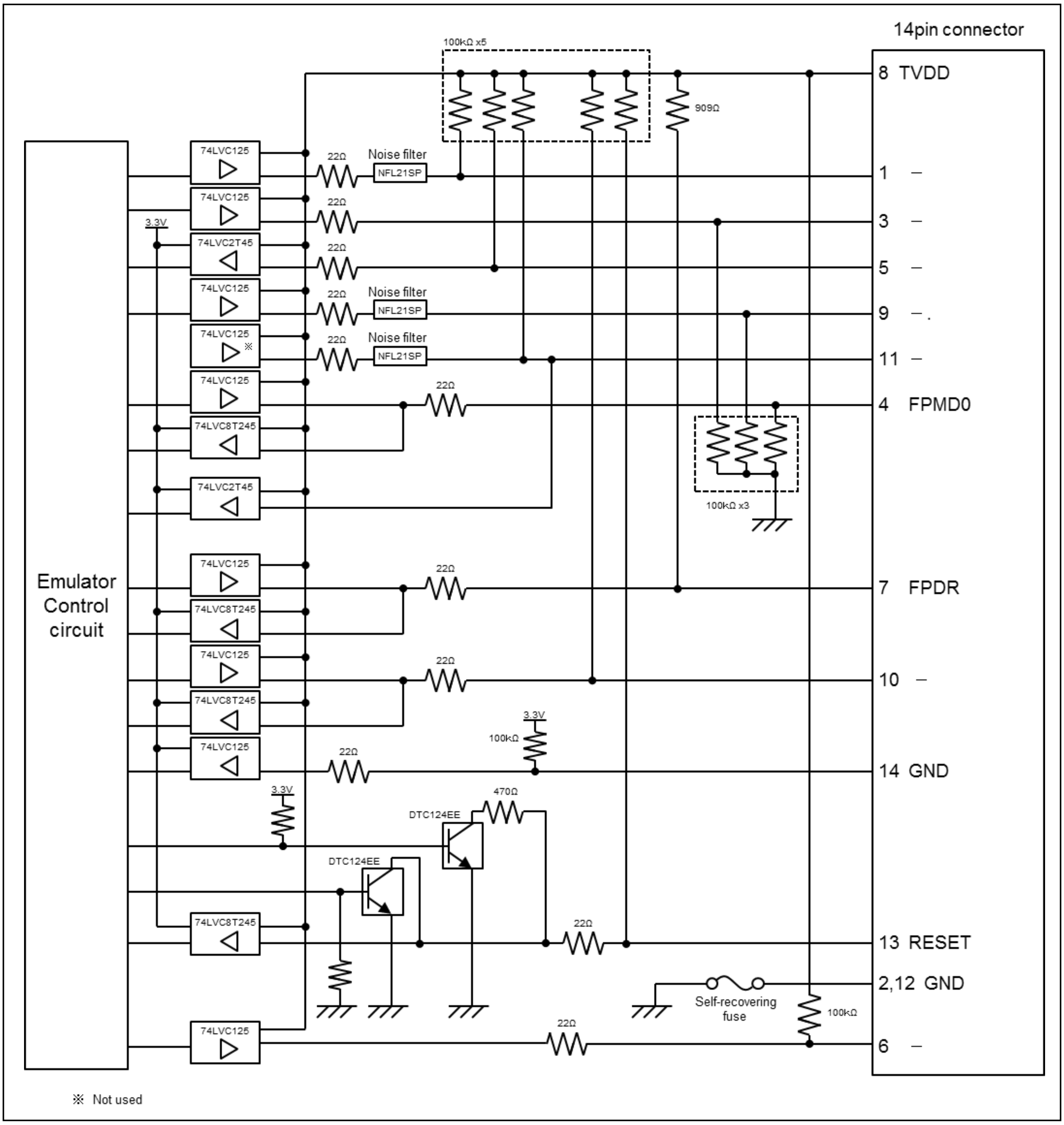

Figure B Interface Circuits in the E1 or E20 Emulator (1-Wire UART)

E1/E20 Emulator
Additional Document for User's Manual (Notes on Connection of RH850/P1M-C and RH850/P1H-C)

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Renesas Electronics America Inc.
2801 Scott Boulevard Santa Clara, CA 95050-2549, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100191, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, P. R. China 200333
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HALII Stage, Indiranagar, Bangalore, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
12F., 234 Teheran-ro, Gangnam-Gu, Seoul, 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

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E1/E20 Emulator

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